

REMARKS

This is a full and timely response to the Office Action mailed November 7, 2003.

By this Amendment, claim 1-15 have been amended, claims 16 and 17 have been canceled without prejudice or disclaimer to their underlying subject matter, and new claims 18-21 have been added. The claim amendments have been effected to put the claim in better form under U.S. practice. Further, claim 15 has been amended to incorporate the limitations of claims 16 and 17. Finally, claims 18-21 have been added to further protect specific embodiments of the present invention. Support for these amendments can be found variously throughout the specification, see for example, the original claims and page 4, lines 13-22, and page 14, lines 8-11, of the specification. Claims 1-15 and 18-21 are pending.

In view of this Amendment, Applicant believes that all pending claims are in condition for allowance. Reexamination and reconsideration in light of the above amendments and the following remarks is respectfully requested.

Rejections under 35 U.S.C. §112

Claims 1-17 are rejected under 35 U.S.C. §112, second paragraph, for alleged indefiniteness. Applicant respectfully traverses this rejection.

However, in order to expedite prosecution, Applicant has amended claims 1-15 to address each issue raised by the Examiner. Specifically, we have amended claims 1-15 to delete the terms "*fine*" and "*high performance*" from the claims. In addition, we have also amended claims 3 and 4 to more particularly define the term "*purity*" to be "*based on the content of tungsten in the total metal component of said solution*". Further, we have amended claim 10 to clarify that the non-oxidizing gas atmosphere is a mixed gas which substantially comprises a nitrogen gas at normal pressure and a CO gas, with the CO gas being produced by the reduction and carburization of the precursor. Lastly, we have effected other amendments to the claims to put them in better form under U.S. practice.

Thus, in view of these amendments, withdrawal of this rejection is respectfully requested.

Rejections under 35 U.S.C. §102 and/or §103

Claims 1-7 and 9-17 are rejected under 35 U.S.C. §103(a) as being

obvious over Kimmel et al. (hereinafter "Kimmel"). Applicant respectfully traverses this rejection.

The claimed invention (claim 1) is directed to a process for producing a tungsten carbide powder, comprising the steps of:

(a) mixing an aqueous ammonium tungstate solution with a carbon powder in a proportion to reduce and carburize ammonium tungstate to form a slurry,

(b) drying the slurry to prepare a precursor,

(c) subjecting the precursor to a reduction and carburization by heating to a temperature, at which a reduction and carburization proceeds, in a non-oxidizing gas atmosphere to form a reduced and carburized product,

(d) mixing the reduced and carburized product with a carbon powder in a proportion required to carburize a W_2C component and/or a W component in the reduced and carburized product into WC, and

(e) subjecting the reduced and carburized product mixed with the carbon powder to a carburization by heating to a temperature, at which a carburization proceeds, in a hydrogen atmosphere.

Other aspects of the claimed invention include (1) the ammonium tungstate in step (a) comprising a purity of at least 99.9% (preferably 99.99%) by weight based on the content of tungsten in the total metal component of said solution, (2) the carbon powder in steps (a) and (d) comprising a purity of at least 99.9% (preferably 99.99%) by weight, (3) the concentration of the aqueous ammonium tungstate solution in step (a) being within a range of 20-70% by weight, and (4) the slurry in step (b) being dried at a drying temperature of not more than 350°C.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. (See §2143 of the Manual of Patent Examining Procedure).

Based on our review of Kimmel, many of the limitations set forth in the claims are not taught or suggested in the reference. Kimmel teaches a conventional process for producing a tungsten carbide powder which is generally described on page 2, lines 13 to page 3, line 4, of the specification. Kimmel discloses mixing ammonium

tungstate with carbon powder and milling the mixed powder (see column 3, lines 53-56 of Kimmel). This is followed by reduction at a temperature of greater than 878°C in a N₂ and CO gas atmosphere, and further carburization at a temperature of about 1200°C in a hydrogen atmosphere (see column 3, line 57 to column 4, line 32).

Thus, Kimmel does not at all teach mixing an aqueous ammonium tungstate solution with a carbon powder at a concentration of 20-70% by weight to form a slurry and drying the slurry at a drying temperature of not more than 350°C to prepare a precursor.

The Examiner addresses this deficiency by arguing that using an ammonium tungstate solution is an obvious expedient to assure the most intimate contact of the reagents (see column 4 of Kimmel) and using the claimed solution strength is an obvious expedient of optimizing solubility and throughput. However, Applicant disagrees with the Examiner in this regard.

Since the Examiner has not cited art with regard to these conclusions, Applicant assumes that the Examiner is taking official notice of facts not in the record or relying on “common knowledge”. However, it must be noted that official notice without documentary evidence to support the Examiner's conclusion is only permissible in rare circumstances when the asserted facts are well-known, or common knowledge in the art capable of instant and unquestionable demonstration as being well-known.

In this case, the conclusions of “*an ammonium tungstate solution is an obvious expedient to assure the most intimate contact of the reagents*” and “*the claimed solution strength is an obvious expedient of optimizing solubility and throughput*” are not capable of instant and unquestionable demonstration as being well-known. Instead, these conclusions require experimental confirmation which prevents the Examiner from taking official notice.

For example, the claimed concentration of the aqueous ammonium tungstate solution being within a range of 20-70% by weight cannot be demonstrated as being well-known since it was only discovered through Applicants' experiments that such a range is optimal. As stated on page 7, lines 20-25, of the specification, if the concentration is less than 20% by weight and exceeds 70% by weight, it becomes difficult to obtain a slurry containing a carbon powder dispersed uniformly therein.

In addition, Kimmel discloses mixing the ammonium tungstate and carbon powders with a blender and a ball mill (see column 3, lines 53-56, and column 4, line

9-11, of Kimmel) which teaches away from the present invention. As stated on page 7, lines 15-18, of the specification, the process of the present invention does not require any mechanical milling step which means that the contamination by metal impurities from the milling step can be avoided.

Still further, Kimmel teaches away from using an aqueous solution by stating that "*Tungsten particle growth is affected by water vapor deposition reaction which occurs in the reduction powder bed*" (see column 1, lines 51-53, of Kimmel).

As stated earlier, in order to establish a *prima facie* case of obviousness, there must be some suggestion or motivation, either in Kimmel or in the knowledge generally available to one of ordinary skill in the art, to modify Kimmel to use an aqueous ammonium tungstate solution for mixing with carbon powder. However, such a suggestion or motivation is not present in Kimmel since it discloses a blender and a ball mill. Further, the Examiner's motivation based on common knowledge (i.e. *an ammonium tungstate solution is an obvious expedient to assure the most intimate contact of the reagents*") is not capable of instant and unquestionable demonstration as being well-known. Thus, the Examiner cannot sustain this rejection.

Finally, it should also be noted that the claimed process produces a tungsten carbide powder unexpectedly superior to that disclosed in Kimmel. As demonstrated in the Examples on pages 11-15 of the specification, the claimed tungsten carbide powder has a higher purity (at least 99.9% by weight), and a smaller average particle size of 0.8 μm or less than Kimmel's carbide powder which result in cemented carbides of a higher strength than that of comparative cemented carbides produced by commercially available fine tungsten carbide powders such as that disclosed in Kimmel.

Thus, for these reasons, withdrawal of this rejection is respectfully requested.

Claims 15-17 are rejected under 35 U.S.C. §102(b) as being anticipated by or, in the alternative, under 35 U.S.C. §103(a) as being obvious over Kimmel et al. Applicant respectfully traverses this rejection

Since, as discussed above, Kimmel's process is substantially different than that of the present invention, one skilled in the art cannot reasonably expect the tungsten carbide powder of Kimmel et al. to comprise the claimed particle size, tungsten content and impurities of claim 15.

As discussed in the specification, contamination by metal impurities such as iron, cobalt, nickel and chromium from stainless steel containers and cemented carbide balls during mixing (via blender or ball mill) cannot be avoided in Kimmel's process. As a result, it becomes impossible to maintain an ammonium tungstate and carbon purity of 99.9% or higher. Further, coarse WC particles are locally produced during reduction and carburization by the influence of these metal impurities. Still further, when using a powder containing the coarse WC particles as a raw material, a reduction in strength is likely to be caused by the coarse WC particles as origins of fractures. Therefore, it is difficult to produce a high-performance fine tungsten carbide powder using the process disclosed in Kimmel.

It should also be noted that Kimmel does not teach or suggest either expressly or inherently a tungsten carbide powder comprising the content of nitrogen and that of oxygen in crystal lattices being respectively within a range of 0.08-0.20% by weight and 0.10-0.35% by weight and a lattice constant of an a-axis and that of a b-axis being respectively within a range of 0.29020-0.29060 nm and 0.28380-0.28420 nm.

Thus, for these reasons, withdrawal of this rejection is respectfully requested.

Requested References

In the action, the Examiner requested further characterization of the teachings in previously submitted Martorana, Akimoto (JP 50-127900), and JP 49-42600. Applicants have submitted herewith full-text English translations of the requested references for the Examiner's review and consideration.

Applicants have also submitted a computer generated English translation of JP 2002-529360 for the Examiner's review and consideration.

CONCLUSION

For the foregoing reasons, all the claims now pending in the present application are believed to be clearly patentable over the outstanding rejections. Accordingly, favorable reconsideration of the claims in light of the above remarks is courteously solicited. If the Examiner has any comments or suggestions that could place this application in even better form, the Examiner is requested to telephone the undersigned attorney at the below-listed number.

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Respectfully submitted,

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